NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

(No.)
CODE 317

DEFINITION

A facility for the biological stabilization of waste organic material.

SCOPE

This standard establishes the minimum acceptable requirements for design, construction, and operation of composting facilities. Waste organic material for composting may include livestock and poultry manure, dead animal carcasses, and food processing wastes where food is processed as part of normal farming operation. Municipal sludge, solid waste, and other non-farm type wastes are not included in this standard.

Types. Three types of composting operations are covered in this standard—aerated windrows, static piles, and in-vessel. Aerated windrows are more suited to large volumes of organic material that are managed by power equipment used to turn the composting material periodically. Periodic turning re-aerates the windrows, promoting the composting process.

Organic material in static piles is initially mixed to a homogeneous condition and not turned again throughout the composting process. Static pile material must have the proper moisture content and bulk density to facilitate air movement throughout the pile. Forced air might be necessary to facilitate the composting process.

In-vessel composting in a totally enclosed structure is carried out on a blended organic material under conditions where temperature and airflow are strictly controlled. In-vessel composting also includes naturally aerated processes where organic materials are layered in the vessel in a specified sequence. Layered, in-vessel materials are usually turned once to facilitate the process. Vessel dimensions must be consistent with equipment to be used for management of compost.

PURPOSE

To treat waste organic material biologically by producing a humus-like material that can be recycled as a soil amendment and fertilizer substitute or otherwise utilized in compliance with all laws, rules, and regulations.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where: (1) waste organic material is generated by agricultural production or processing; (2) composting is needed to manage the waste organic material properly; (3) an overall waste management system has been planned that accounts for the end use of the composted material.

GENERAL CRITERIA

Plans for a composting facility shall comply with all applicable Federal, State, and local laws and regulations (Refer to the reference section at the end of this standard).

Operations that compost dead animals are subject to permitting regulations of the Utah Division of Solid and Hazardous Waste (SHW). Contact SHW at (801) 538-6170 for information on these requirements.

NRCS, UT
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DESIGN CRITERIA

Location. Composting facilities shall be located:

- Where there is low risk of pollution to any downslope water conveyance system, waterbody, well, or other water source
- Outside of wetlands, watercourses, and 100 year flood plains
- Where clean water can be diverted from the area
- Outside of low depression areas
- On slopes from 2 to 4%
- Where access is practicable during poor weather conditions such as when the ground is snow covered, icy, or muddy,
- Where discharges will not occur during a 25-year, 24 hour storm,
- Outside of a public drinking water source protection Zone 1 or 2
- Where soils have slow to moderate permeability to minimize the potential for groundwater contamination
- Outside of areas where soils (within 3 feet of the soil surface) are sandy, gravelly, or where a high water table or bedrock exits.

Site Preparation. Evaluate site needs for grading, shaping, lining, paving, and soil compaction in relation to proper equipment operation, site accessibility, and for potential ground water contamination from the leaching of nutrients and petroleum products.

Berms and/or diversions shall be placed, as needed, to contain runoff from a 25-year, 24-hour storm plus the average amount of precipitation expected. All side slopes for any excavation or berm shall not be steeper than three horizontal to one vertical (3:1).

Where drainage from the facility will be directed into a storage pond, provisions will be made to protect the area from excessive erosion.

Diversions shall be placed, as needed, to divert clean water away from the compost facility.

Carbon-Nitrogen Ratio. Calculate the amounts of the various ingredients to establish the desired carbon-nitrogen ratio (C:N) of the mix to be composted. The C:N should be between 25:1 and 40:1. Use the higher range of C:N for organic materials that decompose at a high rate (or are highly unstable) with associated high odor production.

Where more than two ingredients are to be blended, the two main ingredients are to be used in the analysis for the desired C:N and mixed accordingly. Adding up to 50 percent by weight of other ingredients to improve workability and air movement is permissible as long as the C:N of the added ingredient does not exceed the target C:N of the compost.

Odor. Select carbon materials that, when blended with the organic material, will result in the desired pH. The blended material should have a pH at or slightly below neutral for best odor control. Where odors do not present a problem, pH of 8 to 9 is acceptable, but strong ammonia and sulfur dioxide odors will be present for the first 2 weeks.

Locate composting operations where movement of odors toward neighbors will be minimized. Buffer areas, vegetative screens, and natural landscape features can help minimize the effects of odors.

Facility Size. Where dead poultry and other small farm animals are composted, establish the size of the composter units on the basis of locally determined animal loss rates. Composting facilities for the purpose of processing animal carcasses are to include a primary composting unit into which alternate layers of low moisture content manure (unusual poultry manure), carbon source material (straw is common), and dead animal carcasses are placed. A secondary composting unit is often necessary to complete the composing process.

Moisture. The moisture content of the blended material at start-up of the composting process should be approximately 60 percent (wet weight basis) and maintained between 40 and 60 percent during the composting process. The composting process may become inhibited when moisture falls below

approximately 40 percent. Water used for moisture control must be free of deleterious substances.

Pile Configuration. Compost piles for windrowed and static piles should be triangular to parabolic in shape with a base width to height ratio of about 2 to 1. Increased surface area favorably affects evaporation and natural aeration and increases the area exposed to precipitation in uncovered stacks. Aligning piles north to south and maintaining moderate side slopes maximizes solar warming. Windrows should be aligned to avoid accumulation of precipitation.

Composting Period. The time needed for completion of the process varies with the material and must continue until the material reaches a stability level at which it can be safely stored without creating undesirable odors and poor handling features. Acceptable stability occurs when microbial activity diminishes to a low level. Stability can be obtained in about 21-28 days but can require up to 60 days to produce the desired quality. Visual inspection and temperature measurements will provide needed evaluation of compost status.

Storage. It may be desirable to store the compost in a storage facility. If so the facility should be sized for the appropriate storage period. Composted materials may otherwise be protected from the weather by roofs or other suitable covers. Structures must meet the requirements of conservation practice standard, “Waste Storage Structure”, Code 313.

OPERATION CRITERIA

Temperature. For best results, operating temperature of the composting material should be 130 °F to 170 °F once the process has begun. It should reach operating temperature within about 7 days and remain elevated for up to 14 days to facilitate efficient composting. The material should remain at or above 110 °F for the remainder of the designated composting period.

If temperature falls significantly during the composting period and odors develop, or if material does not reach operating temperature, investigate piles for moisture content, porosity, and thoroughness of mixing. Compost managed at the required temperatures will favor destruction of any pathogens and weed seeds.

Aeration. Heat generated by the process causes piles to dehydrate. As the process proceeds, material consolidates, and the volume of voids through which air flows decreases. Materials selected for the composting mix should provide for adequate air movement throughout the composting process. Periodically turning the pile and maintaining proper moisture levels for windrows and static piles will normally provide adequate aeration.

Equipment Needs. Appropriate equipment must be available for initial mixing, turning, and hauling composted material and carbonaceous material. Appropriate long stem thermometers should also be available for managing the composting material.

Nutrients. Keep compost well aerated to minimize nitrogen loss by denitrification. Keep pH at neutral or slightly lower to avoid nitrogen loss by ammonification. High amounts of available carbon will aid nitrogen immobilization. Phosphorus losses will be minimized when the composting process is managed according to the requirements of this standard. Include compost nutrients in nutrient management plans, determine the effects of use and management of nutrients on the quality of surface water and ground water as related to human and livestock consumption.

Testing Needs. Test compost material for carbon, nitrogen, moisture, and pH if compost fails to reach desired temperature or if odor problems develop. The finished compost material should be periodically tested for constituents that could cause plant phytotoxicity as the result of application to crops. Test composted materials that are prepared for the retail market for pH, nitrogen, phosphorus, potassium, moisture content, and bulk density.

PLANNING CONSIDERATIONS

Process. Composting is a process using aerobic microorganisms to digest organic waste. The process will occur within a broad range of conditions, however, having the right temperature, moisture content, and carbon to nitrogen ratio speeds up the process. Having the correct proportions of the various compost ingredients will minimize odors and avoid attracting flies, rodents, and other small animals.

Carbon Source. A dependable source of carbonaceous material should be available. The material should have a high carbon content and high carbon to nitrogen ratio (C:N). Wood chips, sawdust, straw, corn cobs, and well bedded horse manure are good sources of carbon.

Moisture Control. Large amounts of water evaporate during the composting process because operating temperatures drive off water. A source of water should be available for compost pile moisture control from start-up through completion. Proper moisture facilitates the composting process and helps control odors.

Bulking Materials. Bulking materials may be added to enhance airflow within the composting material. Piles that are too compact will compost much more slowly. Straw, sawdust, wood chips, grass clippings, etc. can be used as bulking materials. Large diameter materials that are not composted completely can be screened and reused.

Management. Composting operations require close management. Management capabilities of the operator and availability of labor should be assessed as part of the planning process.

Economics. Benefits associated with the intended use of the compost should be compared to the cost of producing the compost. Benefits in addition to cost return, can include environmental protection, improved handling, disposal of dead farm animals, odor control, and reduced need for storage volume.

PLANS AND SPECIFICATIONS

Plans and specifications for an individual composting facility shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

A written operation and maintenance plan shall be developed with full knowledge and input of the owner-operator and included with the documents provided to the owner-operator.

REFERENCES

"Definitions and General Requirements", R317-1, Utah Administrative Code (UAC), Utah Department of Environmental Quality (UDEQ), Division of Water Quality (DWQ)

Dougherty, Mark, *"Field Guide to On-Farm Composting"*, Northeast Regional Agricultural Engineering Service, (NRAES-54) Ithaca, NY 14853-5701, April 1999

"Ground Water Quality Protection", R317-6, UAC, UDEQ, DWQ

Pace, M.G., B.E. Miller, K.L. Farrell-Poe*, "The Composting Process"*, AG-WM 01, Utah State University Extension, October, 1995

"Drinking Water Source Protection for Groundwater Sources", R309-600, UAC, UDEQ, DWQ

Rynk, Robert*, "On-Farm Composting Handbook"*, Northeast Regional Agricultural Engineering Service, (NRAES-114) Ithaca, NY 14853-5701, June, 1992

"Solid Waste Permitting and Management Rules", R315-312, UAC, UDEQ, Division of Solid and Hazardous Waste

"Standards of Quality for Waters of the State", R317-2, UAC, UDEQ, DWQ

"Utah Pollutant Discharge Elimination System (UPDES)", R317-8, UAC, UDEQ, DWQ

“Utah Water Quality Act”, 19-5, Utah Code, UDEQ, DWQ